

# How to Check Incubation Temperature

Aviagen Turkeys Ltd ®



## Definition

- This advice sheet will describe how to measure incubation temperature and interpret the results.
- The correct temperature is critical for incubation success and even deviations of 1.0°C (1.8°F) from the optimum can have a major impact on hatching success. Therefore it is essential that hatcheries carefully control incubation temperature.
- When discussing incubation temperature it is important to appreciate that the temperature experienced by the embryo is not the same as the temperature indicated on the front of an incubator and it is embryo temperature that is the critical factor for success.
- The difference between setter and embryo temperature will depend on several factors but primarily on the rate of heat transfer between egg and incubator air (determined by airflow) and the amount of metabolic heat generated by the embryo (determined mainly by embryo age).

## Procedures

There are several methods that can be used for identifying incorrect egg temperatures.

1. Incorrect incubation time
  - If egg temperature is too high then incubation time will be advanced and the opposite is true if egg temperature is too low. Incubation time can be a good early indicator of temperature problems.
  - Normal incubation times for B.U.T. lines are given in [Management Advice Sheet – Incubation Times of B.U.T. Strains](#).
2. Handheld infrared thermometer
  - Handheld infrared medical thermometers for checking ear temperature are relatively cheap and accurate tools for measuring egg surface temperature.
  - The thermometer should be placed against the shell just below the shoulder of the egg to obtain a reading (Figures 1 & 2). It is important that the disposable plastic cap supplied with the thermometer is fitted when taking the reading.
  - This technique is excellent for obtaining spot checks on egg temperatures within incubators, particularly those in which it is possible for the operator to enter the machine while it is operating. However, there are difficulties in setters where it is not possible for the operator to enter the machine while it is running or determining the temperature within the mass of eggs.
  - The target eggshell temperature for turkey eggs is 37.8 – 38.0°C (100 – 100.5°F). In most cases there will be some egg-to-egg temperature variation so the objective will be to get as many eggs as possible within the target range. Be more concerned about incubation temperatures that exceed the target range. Note that infertile and

early dead germ eggs will have a lower temperature after day 12 of incubation, as these eggs are not generating any metabolic heat.



Figure 1. Infrared thermometer.



Figure 2. Measuring egg temperature using an infrared thermometer.

### 3. Data loggers with thermistor probes

- It is possible to obtain data loggers (Figures 3 & 4) with one or more external thermistor(s) that can be taped to the egg on the centre of a setter tray. When choosing this type of equipment it is important that the readability of the instrument is at least to 0.05°C (0.1°F) and as accurate as possible.
- The advantage of this type of equipment is that it can be located within the centre of the egg mass and provide a continuous record of temperature throughout the whole incubation period. The difficulty is that the thermistor will measure the temperature of the air around the egg rather than the surface temperature and in most cases this will underestimate the egg temperature.
- Target air temperatures around the egg are shown in table 1.



Figure 3. Data-logger.



Figure 4. Positioning of data-logger probe on egg tray.

Table 1: Minimum and maximum air temperatures around turkey eggs.

Week of Incubation	Temperature (°C)	
	Minimum	Maximum
1	37.5	38.1
2	37.5	37.7
3	37.0	38.1
4	37.0	38.1

#### 4. Dead-in-shell breakout analysis

- Studies have shown that high incubation temperatures will show some typical patterns of embryo mortality:
  - Increased incidences of mortality in the 16 – 24 day of incubation.
  - Increased incidence of embryo malposition, particularly upside-down.
  - Increased incidence of eye cataracts, oedematous heads, swollen down plumules, ruptured yolk sacs and excess albumen.
- Low incubation temperatures tend to be associated with:
  - Increased incidence of late hatching or live unhatched embryos.
- See [Management Advice Sheet: Hatch break-out analysis](#) for further information.

### Correcting Incubation Temperature

It is not possible to provide complete advice on how to correct incubation temperature problems that applies to all types of incubators, but the following issues should be considered.

- If all the eggs are either too warm or cold:
  - Is the incubator correctly calibrated?
  - Can the incubator operating temperature be raised or lowered to bring the eggs into the correct target range?
  - In multi-stage incubators are the correct setting patterns being applied?
  - Can the airflow around the eggs be increased to reduce temperature?
- If there are hot or cold spots within the incubator:
  - If there are multiple temperature control sensors are they all correctly calibrated?
  - Is there a uniform airflow around the eggs within the machine? Is airflow being restricted by insufficient space between egg trays?
  - In multi-stage incubators, are the correct setting patterns being applied?
  - Are the incubators over ventilated so that too much cool, dry air is being brought into the machines?
  - If spray humidifiers are being used, are they wetting the eggs or not functioning correctly? Are all heater bars working correctly? Has the machine been properly maintained?

## Related Management Advice Sheets

- a. [Incubation Times for B.U.T. Strains.](#)
- b. [Multi-stage incubation.](#)
- c. [Single-stage incubation.](#)
- d. [Hatch break-out analysis.](#)
- e. [Hatchery calibration.](#)
- f. [Hatchery maintenance.](#)

## Related Website Articles

1. [The Egg Takes Control.](#)
2. [Incubating Single-stage.](#)

## Further Reading

1. French, N.A. (1994) Effect of incubation temperature on the gross pathology of turkey embryos. *British Poultry Science*. **35**: 363 – 371
2. French, N.A. (1997) Modeling incubation temperature: The effects of incubator design, embryonic development and egg size. *Poultry Science*. **76**: 124 – 133.
3. French, N.A. (2000) Effect of short periods of high incubation temperature on hatchability and incidence of embryo pathology of turkey eggs. *British Poultry Science*. **41**: 377 – 382.
4. French, N.A. & Houlbrooke, R.J. (2004) A long-term study of the environment within a tunnel incubator for turkey eggs. *Journal of Applied Poultry Research*. **13**: 77 – 84.

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